

## **ABSTRACT OF THE DISCLOSURE**

3,3'-Substituted chiral biaryl phosphine and phosphinite ligands and metal complexes based on such chiral ligands useful in asymmetric catalysis are disclosed. The metal complexes are useful as catalysts in asymmetric reactions, such as, hydrogenation, hydride transfer, allylic alkylation, hydrosilylation, hydroboration, hydrovinylation, hydroformylation, olefin metathesis, hydrocarboxylation, isomerization, cyclopropanation, Diels-Alder reaction, Heck reaction, isomerization, Aldol reaction, Michael addition, epoxidation, kinetic resolution and [m+n] cycloaddition. The metal complexes are particularly effective in Ru-catalyzed asymmetric hydrogenation of beta-ketoesters to beta-hydroxyesters and Ru-catalyzed asymmetric hydrogenation of enamides to beta-amino acids.